

CALIFORNIA DIVISION OF MINES AND GEOLOGY

FAULT EVALUATION REPORT FER-143

Kern Front, New Hope, and Premier Faults, Kern County

by

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INTRODUCTION

The Kern Front, New Hope, and Premier faults are located in the Oildale and North of Oildale 7.5-minute quadrangles (Figure 1). These faults are being evaluated as part of a state-wide effort to identify recently active faults and zone those faults determined to be sufficiently active and well-defined (see Hart, 1980). As indicated below, each of these faults has been reported to be an active, creeping fault (Bartow and Doukas, 1978; Castle and others, in press; see Figures 2A, 2B, 3A, 3B, and 3C). Also, an unpublished memo (Smith, 1978) in the Fault Evaluation Program files indicates that the trace of the Kern Front fault shown on the existing Special Studies Zones map (CDMG, 1976a) locally is more than 500 feet away from the true trace of the creeping fault, and that the fault may extend northward into the North of Oildale quadrangle.

All three of the faults evaluated herein are westerly dipping, generally north-south striking, normal faults. These faults lie at the southern end of the western flank of the Sierra Nevada foothills. The location of the three faults, as well as the orientation, style, and sense of displacement, appears generally similar to the fault rupture which occurred in 1975 along the Cleveland Hill fault in Butte County, a few hundred miles to the north (see Hart and Rapp, 1975). The lack of detailed geologic studies of the Sierra Nevada foothills, especially in the area south of Mariposa County, does not permit one to draw any firm conclusions regarding whether or not the faults investigated herein are an extension of any postulated system of tectonically active faults (a "Foothills fault system") superimposed on the older faults in the foothills.

A recently completed study by Castle and others (in press) suggests that tectonic forces are probably not responsible for the historic displacements along the three faults investigated, however. Immediately east of each of these three faults (the Kern Front, New Hope, and Premier faults) are oil fields from which large quantities of fluids have been withdrawn. Subsurface information indicates that all of these faults existed prior to the production of oil from this region (Park, 1965; Weddle, 1959). Based on the information they reviewed and the surveys they conducted, Castle and others concluded that this withdrawal of fluids has caused subsidence over the producing areas immediately adjacent to each of the faults and has locally resulted in displacement along each.

SCOPE OF INVESTIGATION

Black and white aerial photographs (U.S.D.A., 1952) of the area were interpreted in order to detect features indicative of faults along which recent displacement has occurred. Numerous lineaments (aligned linear and curvilinear drainages, tonal lineations, scarps, etc.) permissive of recent faulting were noted. Some of these lineaments have apparently resulted from differential erosion of various stratigraphic units. Other features may reflect the existence of one or more faults, some of which are confirmed by the available subsurface data (Park, 1974), but do not, by themselves, demonstrate that active faults exist in the area. Still other lineaments appear to coincide with the faults investigated, based on the field observations made. Selected lineaments are shown on Figures 4A and 4B.

This investigator field checked each of the three faults addressed in this FER during January, April, June, and July 1983 (the field check in June was made in the company of Earl W. Hart, Program Manager). Conclusive evidence of historic fault creep was found along all three zones of normal faults (see Figure 6A and 6B). This evidence, discussed in further detail in the Sections that follow, is consistent with the theory that the historic displacement has been triggered by fluid withdrawal. In addition, the facts that the scarps observed in the field are quite well preserved (considering the forces working upon them), that cracks were locally observed in pavement where no such cracks were noted in 1978 (Smith, 1978), and that the scarp along the Kern Front fault apparently lengthened in a northerly direction suggests that displacement is continuing along one or more of these faults.

The available evidence concerning the existence, location, and activity of each of the three faults is discussed in the following Sections.

KERN FRONT FAULT

Summary of Available Data

The Kern Front fault is a north-south striking, westerly dipping (65° to 75°), normal fault along the eastern margin of the Kern Front oil field (Manning, 1973; Park, 1965; Castle and others, in press; see Figures 2A and 3A). Although the fault has long been recognized in the subsurface by petroleum geologists, it was not until 1943 that mention was made of any associated surface evidence. In that year, Edwards (1943) cited the presence of a reddish oxidized soil along a "shallow topographic furrow" along the fault. Hill (1954) reported that a few inches of aseismic movement occurred in 1949 on a two-mile long segment of a fault located about 8 miles north of Bakersfield. [This investigator has not yet been able to confirm that the Kern Front fault is the subject fault referred to by Hill, but it appears likely that this is the case since a 1952 guidebook shows the fault (Brooks, 1952; Paap and Brooks, 1952)]. In 1965, Park described the Kern Front fault as having a well-defined scarp, and indicated that the average subsurface offset of the Chanac Formation (Mio-Pliocene)/Kern River Formation (Plio-Pleistocene) is about 150 ft.

Manning (1968) reported that the surface trace of the Kern Front fault was marked by a low (6" to 12" high) scarp, and that the roadways crossing the scarp required frequent repairs indicating that fault creep was occurring. Manning (1968) also included a map of the surface trace by Gardner Pittman (Figure 2A). Perhaps in response to the Manning article, the National Oceanographic Survey (N.O.S.) established a creepmeter across the fault in 1968 (the former creepmeter location is noted on Figure 2A in Section 26). The data gathered are summarized in Table 1.

Table 1. Summary of creepmeter data collected by Gardner Pittman for N.O.S. These data report vertical changes and are not corrected for fault dip (from Nason and others, 1974, and Schultz and others, 1977). No data were collected after 1974 at this location.

<u>Date</u>	<u>Yearly Cumulative Change</u>
1968	3.12 mm*
1969	8.38 mm**
1970	12.27 mm
1971	9.70 mm
1972	9.52 mm
1973	8.31 mm
1974	5.26 mm*

*Partial year

**Instrument damaged; some measurements lost

A more recent article by Manning (1973) shows a slightly different location of the Kern Front fault (Figure 2A). An independent field check made by this investigator (Smith, 1978) more closely agrees with Manning (1973) than with Manning (1968) (see Figure 2A). Unfortunately, Manning (1968) was the principal source used for the Special Studies Zones map (California Division of Mines and Geology, 1976b). The creeping trace of the fault is also shown on published maps by Park (1974) and on a small-scale map by Bartow and Doukas (1978). Bartow and Doukas indicate that the Kern Front fault cuts the Kern River Formation (Plio-Pleistocene in age) and older alluvium (Pleistocene). Park (1974) indicates the entire length of the fault is creeping. Bartow and Doukas show the fault as continuing northward, but do not indicate they have any evidence that creep may be occurring on this northern extension. An unpublished map by Castle and others (1975, included herein as Figure 3A) documents the location of the fault, the height of the scarp (in inches), and the depth of some "potholes" along the fault. The mapped trace closely follows that of Manning (1973), but shows many more minor bends than does the latter. Castle and others indicate that the northern limit of the fault scarp was in Section 13 at the time of their mapping. Smith (1978) also documented the existence of a well-defined scarp along the fault and suggested that the creeping trace of the fault may extend northward of the area zoned (Figures 2A and 2B).

Only two site-specific investigations directed at the hazard of surface-fault rupture have been completed along the Kern Front fault (Park and Smith, 1977 [AP-1143]; 1979 [AP-1438]). Both investigations included trenching and neither detected any evidence of a recently active fault on the site investigated. In places the trenches did not extend below the "topsoil", however. Both reports provided information concerning fault-caused deformation of the race track and office building to the northeast (see Figure 2A), but did not report the scarp noted by Smith (1978) near the intersection of Petrol and James Roads. Park and Smith (1977) indicate that cracks were reported in the early 1960's in James and Petrol Roads near the site they investigated. However, these two roads were resurfaced in the late 1960's. Neither Park and Smith (1977) nor this investigator (Smith, 1978) detected any cracks in the asphalt pavement of the two roads in the late 1970's [cracks were found this year, however; see below].

Yerkes and Castle (1969) and Castle and others (in press) reported that the historic movement of the Kern Front fault is most likely the product of subsidence caused by fluid withdrawal associated with oil field operations. They based this conclusion on the fact that the fault movement (1) is associated with measured differential subsidence, (2) continues with continuing extraction, (3) occurs along a pre-existing fault that dips toward the area of subsidence over the Kern Front field, and (4) has not been accompanied by seismicity. Yerkes and Castle also indicate that the movement may have been noted as early as 1943 (they do not cite a source for this date; it is possible that they have interpreted Edward's [1943] reference to a topographic furrow as possible evidence of fault creep). Production data for the area immediately west of the Kern Front fault is presented in Table 2. As can be seen from Table 2, total oil and gas withdrawals have been very large and have increased over the last 38 years.

Interpretation of Aerial Photographs

Features observed on the 1952 photographs along the trace known to be creeping (as summarized above and below) did not impress this investigator. Diagnostic, fault-produced topographic features are lacking along the active trace, suggesting that a large amount of historic fault creep had not occurred prior to 1952. The few tonal lineaments noted were suggestive of bedding or, possibly, beds truncated by faulting, except for one sharp tonal in Section 24, T. 28 S., R. 27 E., the cause of which is unknown.

Based on the available data summarized above and the field observations summarized below, it is likely that the creeping trace would be better displayed on more recent aerial photographs (if of high quality and adequate scale).

Field Observations

Since this investigator had mapped most of the fault in 1978, the field effort was largely limited to checking the location of the features mapped in 1978, with special attention given to the southern and northern ends of the fault (see Figures 6A and 6B).

As noted above, neither Park and Smith, (1977; 1979) nor Smith (1978) detected any cracks in the pavement of James and Petrol Roads. During this investigation, however, numerous cracks were noted in the pavement, forming two subparallel zones. The westernmost zone (Figure 6A) consists of two fresh cracks and one old crack (patched), which collectively form a left-stepping zone of an echelon cracks across James Road. On trend to the south is a 20 foot-wide zone of cracks and break in slope across Petrol Road. The easternmost zone, consists of a narrow (2-foot wide) zone of anastomosed cracks across the intersection of James and Petrol Roads. This zone trends N. 35° E. and is on trend with a joint in a concrete curb. Although evidence of extension at this joint was suggestive but not conclusive, the top of the curb appears spalled at a crack (in the curb) located about 8 feet to the west. This suggests that minor vertical offset (down to the west) may have occurred. No cracks were detected on any streets in a new subdivision to the south (site of AP-1143).

That movement on the Kern Front fault is continuing is suggested by a small inflection in the surface of a new, paved road (Figure 6A, Section 36). Part of the scarp in the northern part of Section 25 apparently has been graded and the creepmeter removed. The locations of scarps and patched pavement across Woody Road (Figure 6A, Sections 24 and 36) were both verified. The oilfield road to the north (west of the center of Section 24) appears to no longer be maintained. A distinct one foot high scarp is present across this roadway and continues to the north across open ground. Piping (sinkhole-like features) and animal burrows appear to be concentrated along the fault in this area. A similar scarp, also about one foot high, is present crossing the road which separates Sections 13 and 24.

To the north, the historically active fault scarp is somewhat discontinuous. Well-defined scarps 200 to 600 feet long are present in Section 15 (Figure 6A), separated locally by 200 to 400 feet of apparently unbroken ground. At the northernmost locality (Figure 6B, Section 12) the scarp is 4 to 6 inches high, trends N. 16° W., and has been obliterated by off-road vehicles (ORVs) to the north. An attempt was made to find the fault north of the ORV play area, but no features indicative of recent faulting were found.

In most of Sections 24 and 15 (Figure 6A), the scarps appeared quite fresh, essentially lacking any vegetation on the face of the scarp. This fresh scarp, which rather clearly indicates that fault creep has occurred quite recently, does not coincide with any older, degraded scarp. This suggests that the creep movement is occurring along an old, Plio-Pleistocene, fault which had been "dormant" for a very long time (a few hundred thousand years or more).

PREMIER FAULT

The Premier fault is described by Weddle (1959) as a locally important, steeply west-dipping, normal fault. The Macoma Claystone Member of the Etchegoin Formation (Pliocene) has been displaced an estimated 45 to 150 feet, down to the west, based on subsurface data. Bartow and Doukas (1978) identified the Premier fault (they did not cite a name) as a creeping fault and as cutting the Plio-Pleistocene Kern River Formation (Figures 2A and 2B). Bartow (oral communication) indicated that the basis for this fault creep information was Castle and others (in press). In 1975, Castle and others documented the height of the scarp along the Premier fault at various localities (Figure 3B). The maximum scarp height they noted was 32 cm in Section 16, about 1200 feet south of the northernmost end of the scarp. They also indicated that an open fissure was noted along the fault by a local geologist shortly before the 1952 Kern County earthquakes. However, vertical movement along the fault was not detected until 1965. By 1975, vertical separation along the fault locally exceeded 30 cm. The total length of the active-fault scarp mapped by Castle and others is about 1.5 miles.

Castle and others (in press) concluded that the historic displacement along the Premier fault probably results from fluid withdrawal. Fluid production in the Premier area of Poso Creek oil field has been substantial.

Interpretation of Aerial Photographs

The surface trace of the Premier fault appears quite well defined by tonal lineaments (Figures 4A and 4B). The cause of these lineaments has not been determined. In Sections 16 and 21, these dark tonal lineaments coincide with the traces mapped by Castle and others (1975), except locally. Similar sharp tonal lineaments continue northward in a somewhat discontinuous zone. As noted later in this FER, fault scarps were found along most of these sharp tonals, and appeared absent only in areas where the ground surface had been highly modified.

Geomorphic features (mainly west-facing scarps) permissive of Holocene fault movement were also locally noted, although such features sometimes do not coincide with the tonal lineaments cited. In Section 16, it appears that features reflecting bedding attitudes are truncated along the tonal lineament. Also, this tonal is located parallel to and slightly east of a subsurface fault (Park, 1974). Thus, the existence of a fault coinciding with the tonal lineament is supported by geomorphic data developed during the interpretation of the aerial photographs as well as data developed during the field reconnaissance.

Field Observations

As noted earlier, Bartow and Doukas (1978) depicted the Premier fault as a creeping fault. On James Road about 150 feet east of State Highway 65 (Figure 4A, Section 21), there are three left-stepping cracks across the pavement. The road surface and asphalt curb are noticeably lower west of these cracks. Curbs on both sides of the road show extension totalling about 1 inch. The vertical offset on this north-south trending zone could be as great as 2 or 3 inches, but might be as little as 1 inch. The roadway appears to be on a fill that is about 3 feet thick; however, since the land on either side of the road has been quarried, this apparent fill could actually be a remnant of original ground. A sand and gravel pit to the south does not quite reach the projected trace of the fault (assuming the cracks noted above are fault-produced), and, therefore, no fault displacements of the gravel and sand horizons were noted. Similar pits to the north appear to lie just west of the fault; no faults were observed in these pits, either.

The southern 3/4 of Section 21 east of State Highway 65 has been extensively graded (Figure 6A). Although Castle and others (1975) indicate that scarps of up to 20 cm in height and associated fissures traverse this area, no sign of these features remain. Immediately north of this graded area, a well-defined, 8-inch high scarp, striking N 15°W, was noted. The fault scarp can clearly be traced to within about 5 feet of a paved oilfield road in the NE 1/4 of Section 21 (Figure 6A). A low (about 1 inch high) flexure was evident in the pavement in July 1983. Cracks in the pavement were rectilinear in this same location. A similar escarpment, three or four inches high, was noted crossing the hardened surface of an old oil sump. In the area south of the sump and north of the paved oilfield road previously described, the fault scarp is essentially a continuous, very well-defined feature along which there are numerous animal burrows that have locally collapsed to form lines of sinkholes with open fissures. This scarp can be easily traced across an active drainage, indicating that it is quite a young feature. Also, grass growing along the fault appeared greener during April, 1983, than did the grass growing on either side of the fault.

In one location in Section 16 (Figure 6A), Castle and others (1975) appear to have mislocated the fault trace. The north-south road shown on the topographic base has been moved westward. Based on the stream location and topography, the fault lies west of where Castle and others depict it. The scarp here is low (3 to 5 inches high) with numerous animal burrows concentrated along it. Locally the ground has collapsed into these burrows.

In Section 9 (Figure 6A), a sharp 8" high scarp is apparent. However, immediately to the south the area has been modified, making detection of the active trace difficult. Near the northern edge of Section 16, the scarp is not a single, sharp feature. However, two rounded escarpments in this modified area are suggestive of recent faulting. In contrast, the fault can be traced with confidence through most of Section 9. Here, the correlation between the scarps mapped in the field and the tonal lineaments observed on the U.S.D.A. (1952) photographs is striking. Virtually every one of these lineaments coincides with a fresh fault scarp. The only exceptions occur in areas where the terrain recently has been highly modified. For example, in the northern 1/4 of the Section the fault is not well expressed, partly due to oilfield activities. Similarly, in Section 4, farming and oilfield operations appear to have obliterated the fault locally. However, the sharp tonal in west-central Section 4 (Figure 4B) was found to coincide with a 6" high scarp that could be traced northward into Section 32. Patched roadways along this scarp were evident, and these paved surfaces consistently exhibited down-to-the-west escarpments.

Attempts were made to trace this fault zone northward without success. The pattern of fault scarps and tonal lineaments suggest the Premier may actually be a locally discontinuous zone of historically active faults which may include the New Hope fault described in the next Section.

NEW HOPE FAULT

The California Division of Mines and Geology zoned the New Hope faults in 1976 (Figure 2B) based primarily on an unpublished map by Manning (1972), supplemented by written information by Park (1972) and Pittman (1973). Pittman apparently discovered evidence of creep (a sag in the road) on the southeasternmost of the two fault segments about 1968 and subsequently informed Manning. Manning discovered the second fault segment while his geology class was conducting a field mapping exercise. Park reports a well-defined scarplet, 6 inches or less in height along parts of the zone. Park (1974) applied the name New Hope fault to the zone. The New Hope fault lies mostly within the Northwest area of the Poso Creek oil field.

Castle (oral communication, 1983) reported that he and Manning had remapped the New Hope fault in April 1975. Unfortunately, he was unable to find a copy of their 1:24,000 scale field map. He indicated that Manning (who could not be contacted) may have the map. Castle did, however, indicate that the fault they mapped was located approximately as shown by Manning (1973), but could not be traced as far northward (see Figure 3C). Castle and others (in press) indicate that historic movement on the New Hope fault is also probably the result of fluid withdrawal. This fault is on trend with the Premier fault to the south and might be connected to the Premier in some manner, although no references actually indicate that these two faults are one in the same.

The existing SSZ map (Figure 2B) shows a possible creep locality on State Highway 65. In 1978, this investigator noted a subtle scarp across the road north of Poso Creek (Figure 6B) which could be traced a short distance on either side. Also in 1978, this investigator did not find any cracks, patched pavement, or scarp in the highway.

Feder (1981 [AP-1404]) conducted a site-specific investigation directed at the hazard of surface-fault rupture (Figure 2B). He trenched across the entire Special Studies Zone and failed to detect any evidence of any fault. However, the trench logs appear somewhat diagrammatic and show several non-horizontal (anomalous) boundaries which bound caliche zones (Figure 5); these boundaries are not described by Feder, and field observations suggest that caliche might locally have concentrated along the "old" fault zone (see below).

Interpretation of Aerial Photographs

Although scarps, tonal lineaments, and aligned drainages are visible on the photographs interpreted in the area surrounding the traces of the New Hope fault mapped by Manning (1973), none of these features precisely align with the mapped fault traces. Only some aligned drainages and an old road appear to be anywhere near the trend and location of the postulated faults, but the aligned drainages actually appear to cross one of the postulated faults without being affected.

Field Observations

As noted above, evidence of fault creep has been reported on the New Hope fault. In January 1983, a narrow zone of cracks was noted crossing the highway (Figure 6B). These cracks may once have been right-stepping, but cracks currently cross the first set forming a rectilinear pattern in the pavement. A slight (1 inch high, down to the southwest) scarp was also present. The zone of cracks trends N 58° W.

The roadcuts east and west of the cracks were examined. The exposed materials appeared to consist primarily of bedded sands of the Kern River Formation. In the eastern roadcut a fracture (N 35° W., dipping 75° SW) was apparent, but no obvious offset was evident. In the western roadcut, three fine, nearly vertical, open cracks were found. The bedding was rather clearly truncated by a fault along which a minimum of 5 feet of down-to-the-southwest displacement had occurred since beds could not be correlated across the fault. Caliche appeared concentrated in a 2 to 4 foot-wide zone immediately south of this fault. Soil at the site was virtually nonexistent. To the northwest, a one-foot high scarp, trending N 30° W, was observed approximately on trend with the cracked roadway. Animal burrows appeared to be concentrated along this scarp. However, the scarp was not apparent north of the oilfield road shown on Figure 6B.

As noted on Figure 2B, Manning depicted two en echelon faults in this area; these faults were also largely verified by Castle and others (1975). This investigator was unable to follow these faults northward of the last described locality. It appears that these scarps may have been obliterated by grading and/or by grazing cattle. Famoso-Woody Road to the north was field checked. No evidence of fault creep was detected.

Southeast of State Highway 65, a well-defined scarp, locally about 1 foot high, was evident. Although the scarp was sometimes difficult to follow, the animal burrows and greener grass concentrated along the zone in April 1983 permitted the fault to be verified as shown on Figure 6B. No cracks were observed across the road leading to the New Hope lease (NE/4 Section 29). However, the road had obviously fallen into a state of disrepair since 1978 when cracks were observed by Smith (1978). To the south of this road, this investigator was unable to detect any scarps or zones of cracks across an alluvial plain or in any of the paved roads on this plain. However, this alluvial plain appears to have been extensively graded and the roads are all fairly new.

DISCUSSION AND CONCLUSIONS

Summary

All of the faults (the Kern Front, Premier, and New Hope) evaluated herein are normal faults that cut Quaternary deposits. None of these faults are major faults, and none exhibit evidence of pre-historic Holocene displacement. However, part or all of each of these faults have been reactivated during historic time as a result of fluid withdrawal. Available evidence suggests that creep has occurred along segments of each of these faults during the past 5 years. It is conceivable that these creeping faults may slowly lengthen northward and southward as fault creep continues. Additional conclusions pertaining to specific faults follow.

Kern Front fault

The Kern Front fault is a well-defined, historically creeping, normal fault, and, therefore, meets the criteria for zoning. Based on field data, the historically active trace extends northward of the existing Special Studies Zone into the North of Oildale quadrangle. The cracks found during this investigation across the intersection of James and Petrol Roads (Figure 6A, Section 35) suggest that the fault extends southward to at least that location. A trench excavated almost immediately south of this location revealed no evidence of Holocene faulting.

Based on the field data presented in this FER and by Castle and others (1975), the fault is not located accurately on the existing 1976 Special Studies Zones maps.

Premier Fault

Based on the available published and unpublished data, the air photo data, and the field data, it appears that the Premier fault is historically active and well-defined. Although scarps could not be detected locally, the correlation between the features observed on the aerial photographs and those observed in the field rather strongly suggests that several well-defined tonal lineaments visible on the photographs result from active faulting. In some areas where similar lineaments were detected on the photographs, the ground surface has been greatly modified by man. There is a good chance that historically active faults exist in such locations and that these faults can be located using subsurface exploration (principally trenching).

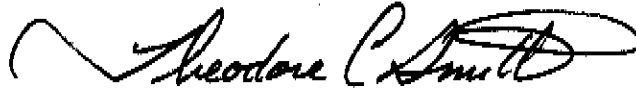
New Hope fault

Based on the field observations of Manning (1972), Castle and others (1975), and this investigator, it appears that the New Hope fault locally is historically active and sufficiently well-defined to warrant zoning. Although this investigator was unable to verify the existence of a creeping fault all along the fault delineated by Castle and others and Manning, a plausible explanation for the destruction of the geomorphic features that reportedly once existed in such locations has been advanced. This investigator concludes that zoning of the fault segments as mapped by Castle and others (in press) appears appropriate.

Some question still exists as to whether the fault is sufficiently well defined northward of where Castle and others verified Manning's (1973) trace. Based on the inability of this investigator to confirm several segments of the faults evaluated herein because the landscape locally has been modified, it is possible that the active trace of the fault once could be mapped as Manning indicates. The only evidence to the contrary is provided by Feder (1981). However, Feder did not explain an apparent discontinuity which includes a caliche zone similar to that noted by this investigator and Earl Hart in the roadcut west of State Highway 65. Therefore, it appears prudent to zone the fault as far northward as Manning shows it to extend.

RECOMMENDATIONS

Based on the evidence summarized above, the existing Special Studies Zones maps of the Oildale and North of Oildale quadrangles should be revised. Castle and others (1975; in press), Manning (1973), and this FER should be used in establishing the revised SSZ's along the Kern Front, Premier, and New Hope faults (see Figures 7A and 7B). Some question still exists as to whether the New Hope fault should be zoned northward of where Castle and others verified Manning's (1973) trace. However, based on the inability of this investigator to confirm several segments of the faults evaluated herein because the landscape locally has been modified, zoning of the fault as far northward as Manning shows it appears warranted.



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*I concur with
the recommendations.
EWH
1/23/84*

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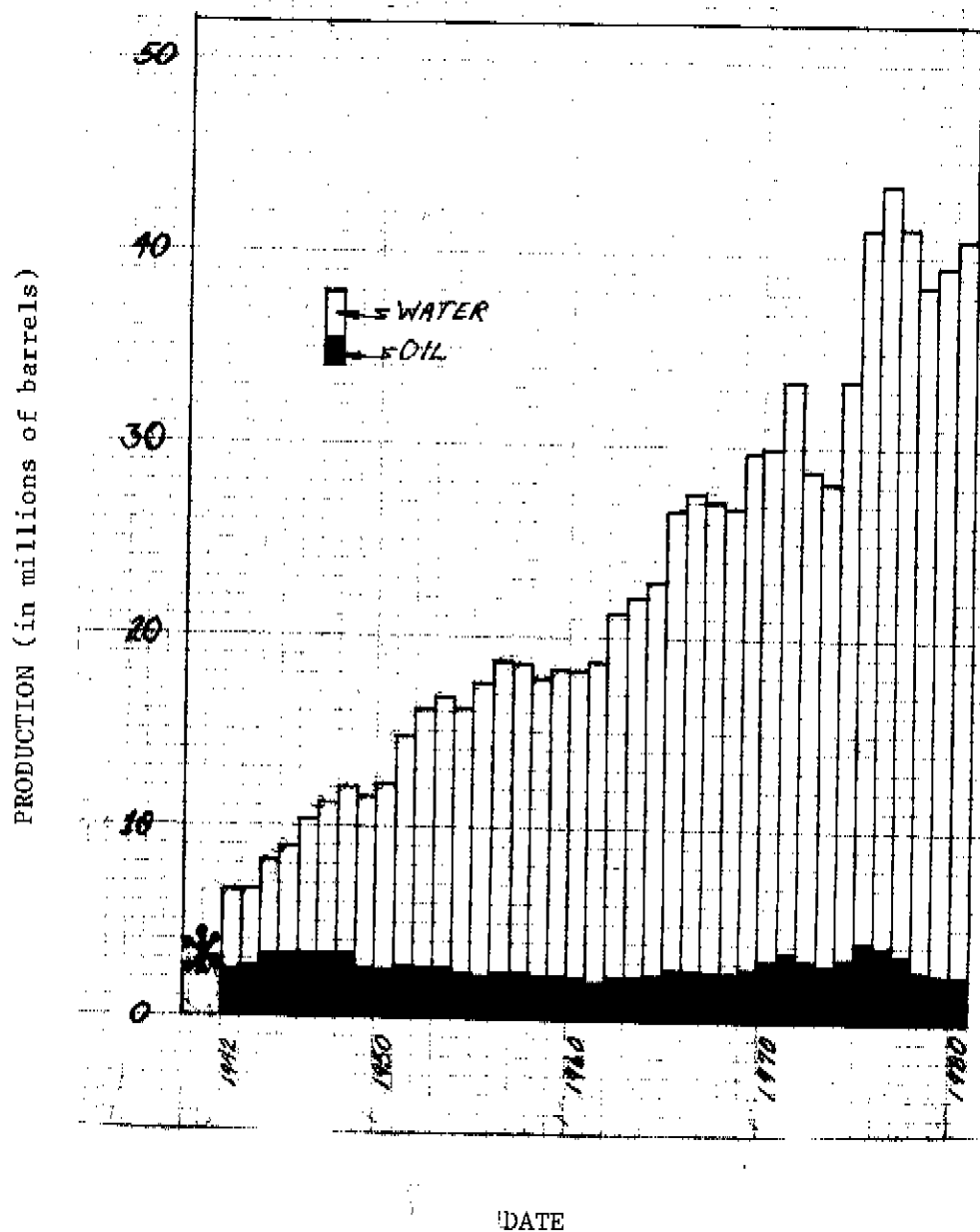
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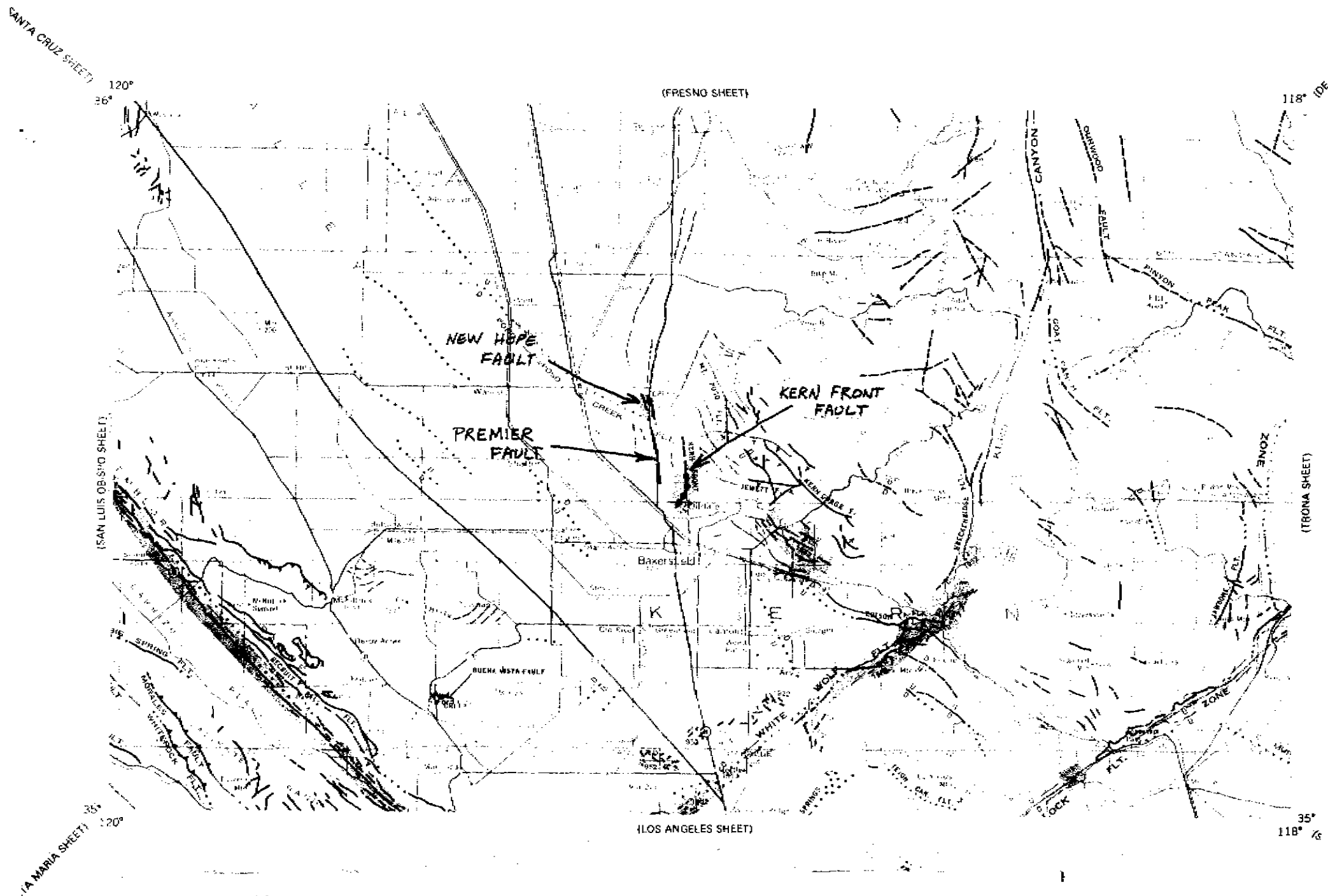
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Table 2.



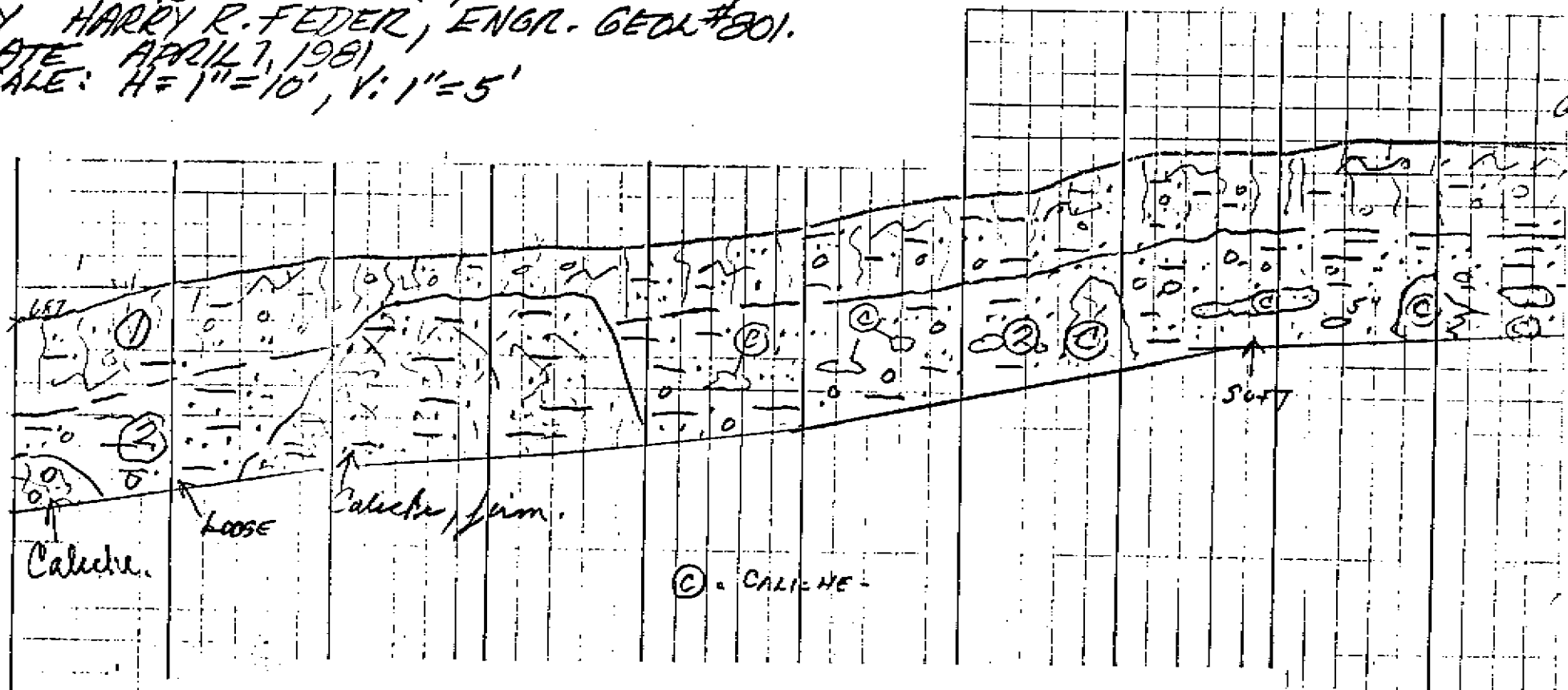
Annual production of fluids, Kern Front oil field. Note: Prior to 1942, Kern Front oil field was considered part of Kern River oil field; data on water production in Kern Front area of Kern River oil field is not available for the years prior to 1942. Compiled by P. Wong from California Division of Oil and Gas and Conservation Committee of California Oil Producers data.



FER-143. Figure 1. Location of the Kern Front, Premier, and New Hope faults (after Jennings, 1975).

TENTATIVE PARCEL MAP 6055
 SEC 17-T27S, R27E, MD.
 Kern Co. Calif.
 ALQUIST-PRICLO SPL. STUDIES ZN.
 FOR: GEORGE M'COURRY
 BY: HARRY R. FEDER, ENGR. GEOL #801.
 DATE: APRIL 7, 1981
 SCALE: H=1"=10', V: 1"=5'

TRENCH # 1
PROFILE



FER-143. Figure 5. Trench log from Feder (1981) showing vertical discontinuities that he did not explain.

TENTATIVE PARCEL MAP 6055

SEC 17-T27S, R27E, MD.

Kern Co. Calif.

ALOUST - PRILO SPL. STUDIES ZN.

FOR: GEORGE MCCOURRY

BY HARRY R. FEDER, ENGR. GEOL #801.

DATE APRIL 7 1981

SCALE: H = 1" = 10', V: 1" = 5'

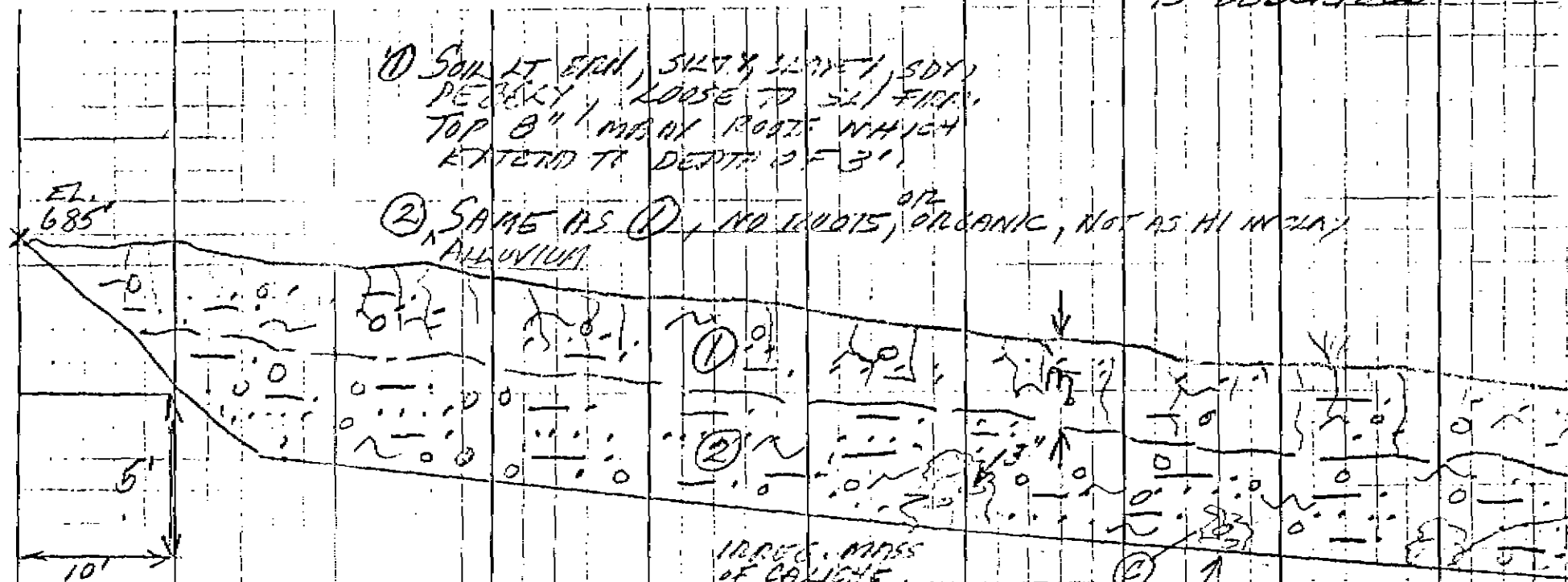
TRENCH # =

PROFILE

NORTH SIDE OF TRENCH
IS DESCRIBED.

① SOIL LT ERM, SLT & SLT, SDY,
PEBBLY, LOOSE TO SLT FIRM,
TOP 8" MANY ROOTS WHICH
EXTEND TO DEPTH OF 3'

② SAME AS ①, NO ROOTS, OR
ALLUVIUM, ORGANIC, NOT AS HIGHLY



IRREG. MASS
OF CALICHE,
FLAT DEFS
W/LS HORIZL
NO SLICKS.

② ↑
CALICHE
CORALS
WELL-ROD
TO 4"

② = CALICHE

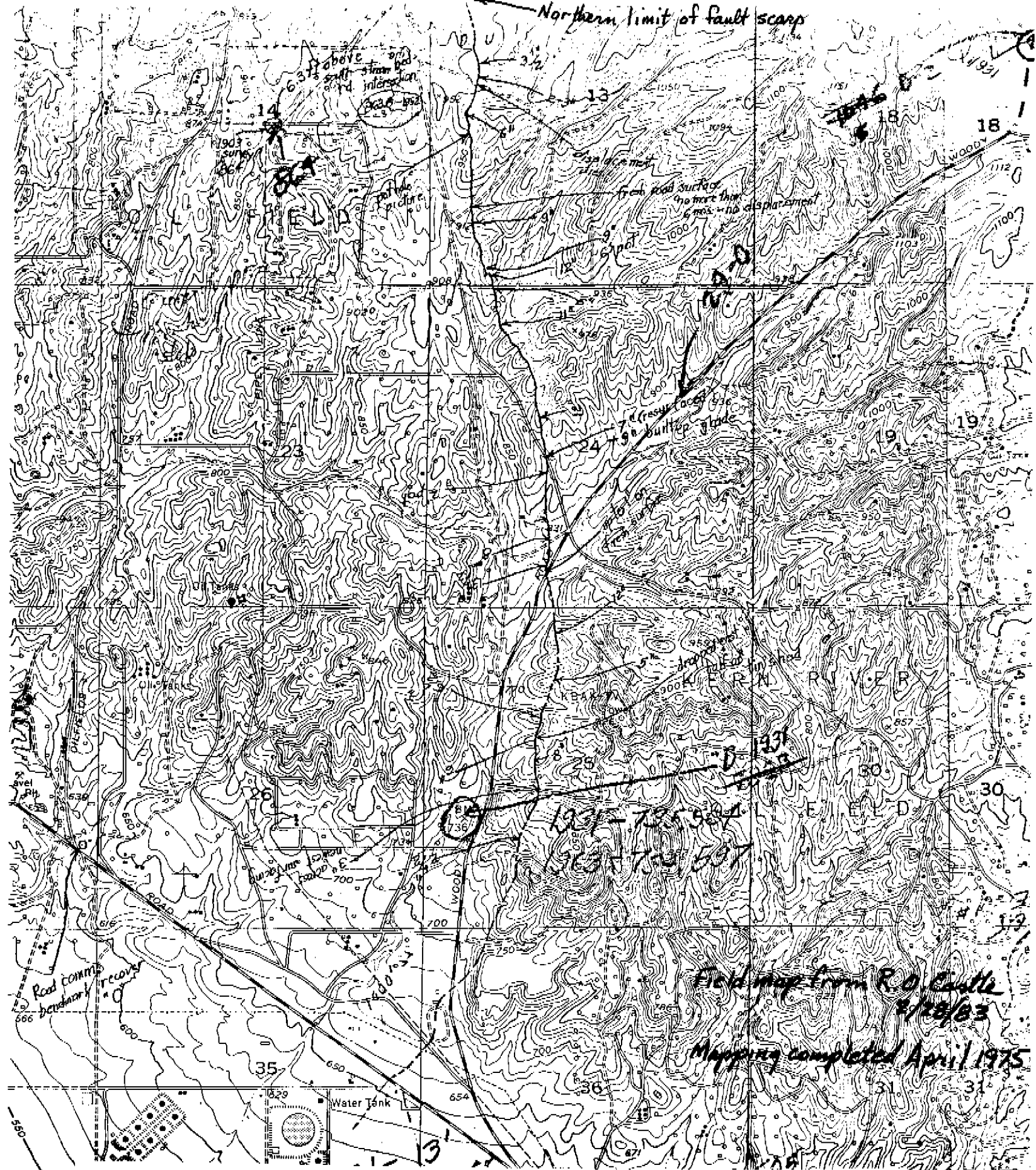
LOCATION: @ SW COR SEC 17,
T27S, R27E, MD.
BEARING N 61° E

TOTAL LENGTH OF
TRENCH 1050' = 1/2
WIDTH OF 1) - @ ONE.

0+00

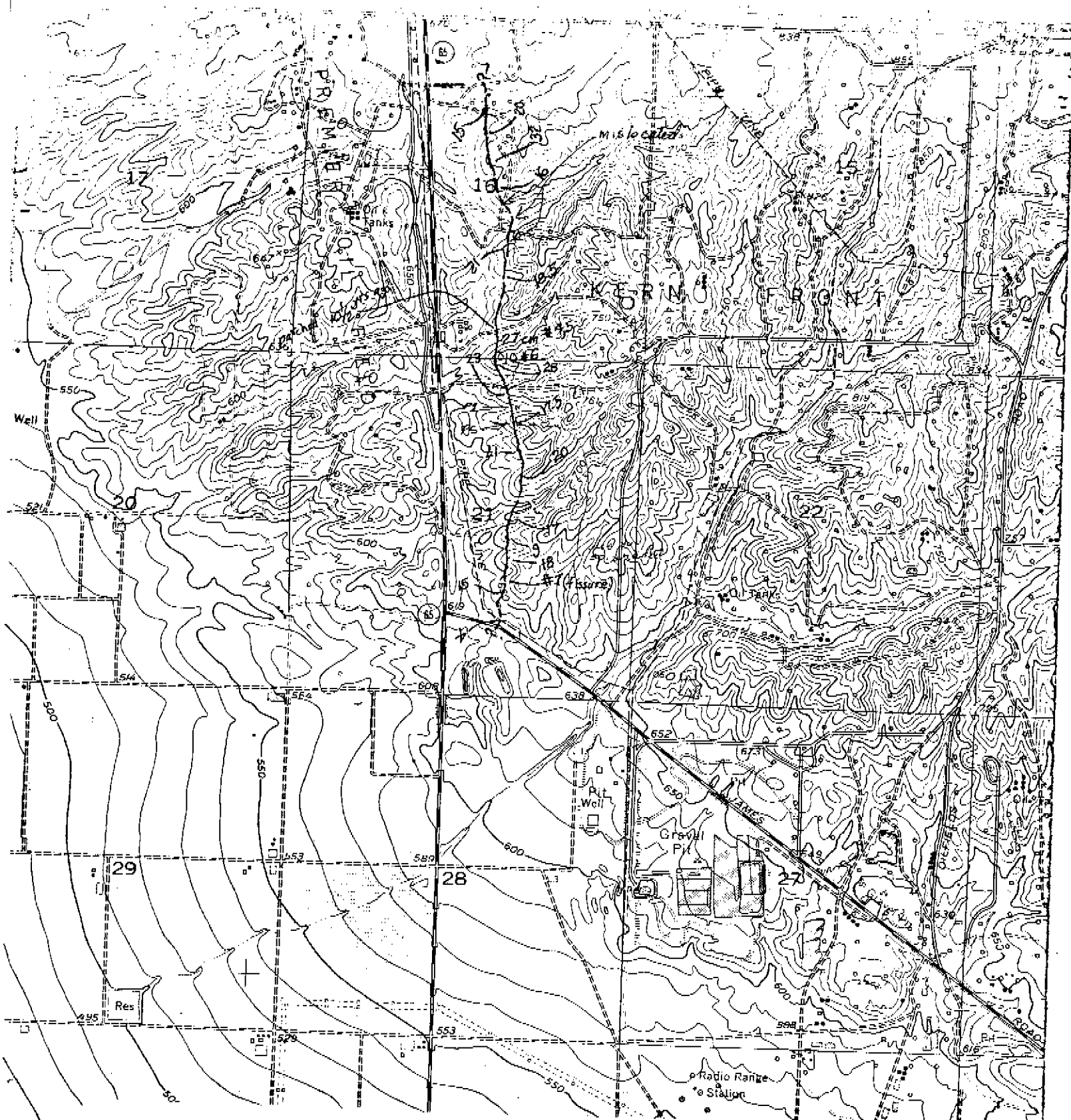
+50

17

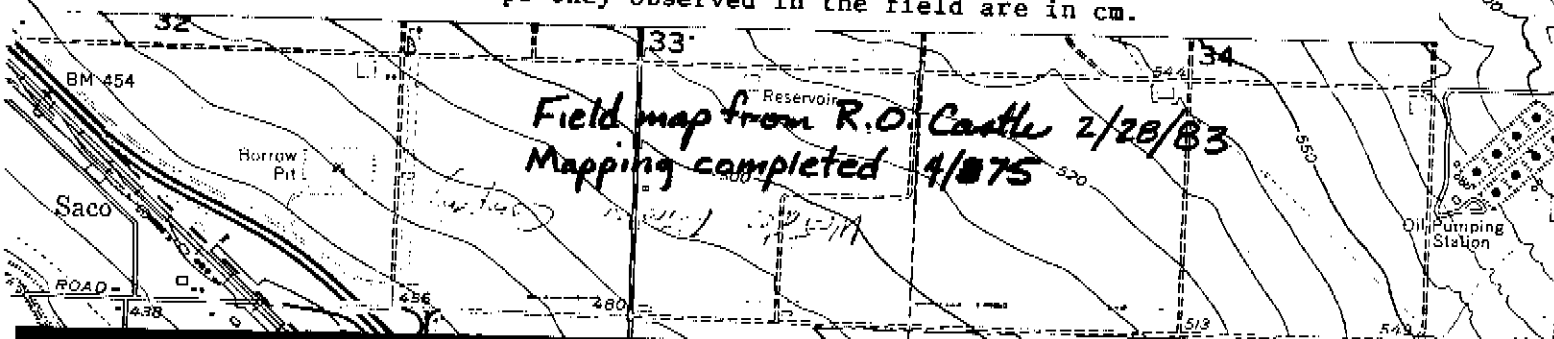


FER-143. Figure 3A. Field map of the Kern Front fault by Castle and others (1975). Heights of scarps they observed in the field are noted (in inches).

B-1 1331

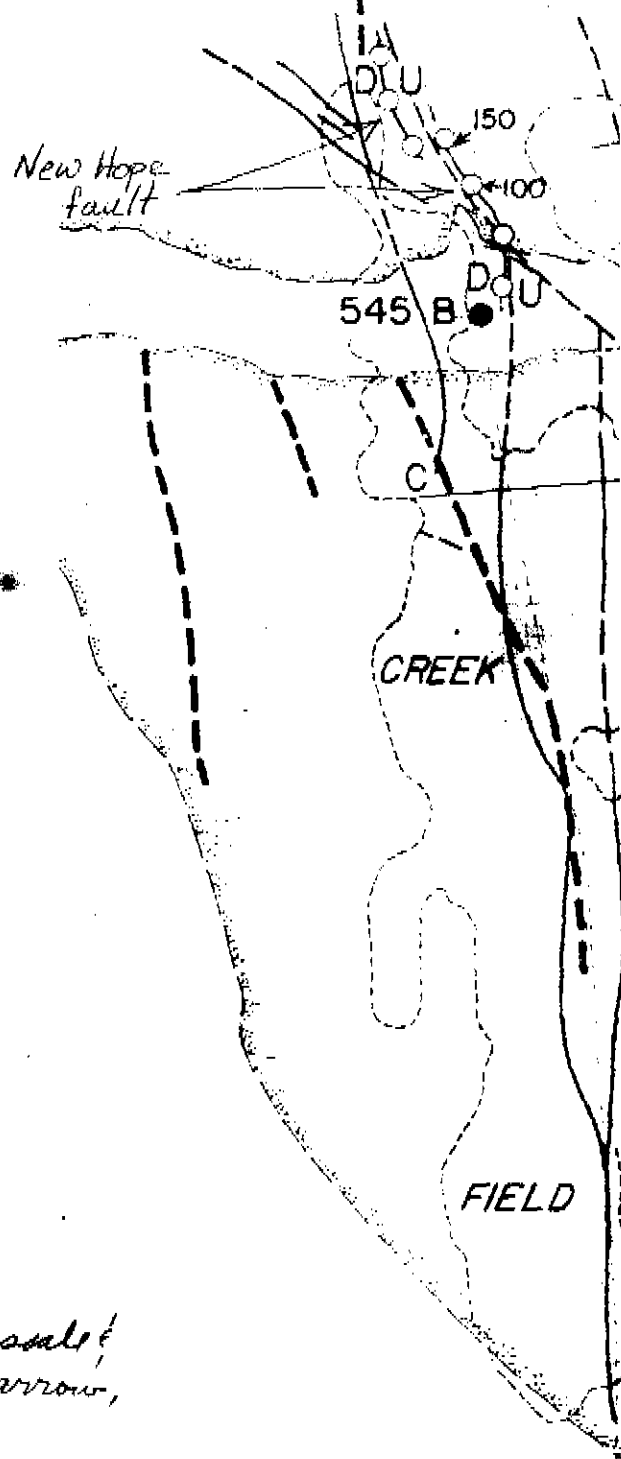


FER-143. Figure 3B. Field maps of the Premier fault by Castle and others (1975). Heights of scarps they observed in the field are in cm.

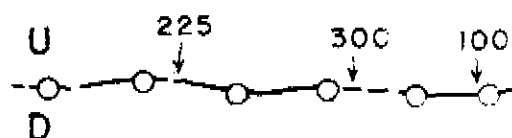


Area

West



EXPLANATION



Historic fault trace

Dashed where approximately located. Figures show vertical separations in mm. U, upthrown side; D, downthrown side

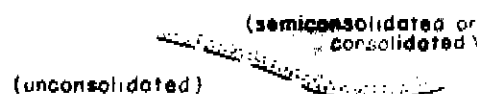


Fault mapped at surface

Dashed where approximately located; queried where doubtful.

Fault revealed in subsurface

Dashed where approximately located. Traces shown on surfaces ranging from 100-1300m below ground level.



Boundary between unconsolidated and semiconsolidated or consolidated deposits.

● 448 B

Bench mark

Oil-field boundary

FER-143. Figure 3C. Portion of a map by Castle and others (in press). Creep localities along the New Hope fault indicated by open circles; scarp heights they observed in 1975 are given in mm.